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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/024,208	12/21/2001	David J. Cooperberg	015290-546	9076

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EXAMINER

ALEJANDRO MULERO, LUZ L

ART UNIT	PAPER NUMBER
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1763

DATE MAILED: 07/27/2005

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APPLICATION NO/ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
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EXAMINER

ART UNIT	PAPER
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0705

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Commissioner for Patents

See the attached Examiner's Answer.

Luz L. Alejandro
Primary Examiner
Art Unit: 1763



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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/024,208
Filing Date: December 21, 2001
Appellant(s): COOPERBERG ET AL.

Edward A. Brown
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 5/17/05 appealing from the Office action
mailed 2/18/05.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

No amendment after final has been filed.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is substantially correct. The plasma processing system recited in claim 9 comprises, *inter alia*, a gas injector extending through the dielectric member such that a distal end of the gas injector is exposed within the processing chamber, the gas injector including at least one on-axis outlet which injects process gas in an axial direction perpendicular to a plane parallel to an exposed surface of the substrate and off-axis gas outlets which inject process gas at an acute angle relative to the plane parallel to the exposed surface of the substrate, the off-axis outlets being circumferentially spaced apart from each

other, the gas injector supplying process gas at flow rates that are independently varied between at least some of the outlets into the processing chamber; a common gas supply in fluid communication with a first gas line and a second gas line, the first gas line being in fluid communication with the on-axis outlet but not with the off-axis outlets and the second gas line being in fluid communication with the off-axis outlets but not with the on-axis outlet.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

The following is a listing of the evidence (e.g., patents, publications, Official Notice, and admitted prior art) relied upon in the rejection of claims under appeal.

WO 99/57747	Chang	November 11, 1999
US 6,450,117	Murugesh et al.	September 17, 2002
US 5,958,140	Arami et al.	September 28, 1999
US 5,532,190	Goodyear et al.	July 2, 1996
US 6,090,210	Ballance et al.	July 18, 2000
WO 00/41212	Ni et al.	July 13, 2000

US 6,287,643	Powell et al.	September 11, 2001
US 4,270,999	Hassan et al.	June 2, 1981

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-7, 9, 11, 13-14, 39, 41-50, and 56-61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang, WO 99/57747 in view of Murugesh et al.,

U.S. Patent 6,450,117 and Arami et al., U.S. Patent 5,958,140, or Goodyear et al., U.S. Patent 5,532,190, or Ballance et al., U.S. Patent 6,090,210.

Chang shows the invention substantially as claimed including a high density plasma chemical vapor deposition system comprising: a plasma processing chamber 38; a vacuum pump system 40 connected to the processing chamber; a substrate support 56 on which a substrate is processed within the processing chamber; a dielectric member 50 having an interior surface facing the substrate support, wherein the dielectric member forms a wall of the processing chamber; a gas injector extending through the dielectric member such that a distal end of the gas injector body is exposed within the processing chamber and comprising a plurality of gas outlets 96/98 including at least one on-axis outlet 96 in the axial end surface and a spaced-apart off-axis outlet 98 in the side surface; a first gas line and a second gas line, the first gas line being in fluid communication with the on-axis outlet but not with the off-axis outlet and the second gas line being in fluid communication with the off-axis outlet but not with the on-axis outlet; flow controllers operable to supply the process gases at flow rates that are independently varied between the on-axis outlet and the off-axis outlets into the processing chamber; a network of valves and throttling elements to vary the gas flow independently between the on-axis outlet and the off-axis outlets; and an RF energy source 89 which inductively couples RF energy through the dielectric member and into the chamber to energize the process gas into a plasma state to process the substrate. Additionally, note that the gas injector comprises an injector body including at least first and second gas inlets, at least first and second gas passages, and at least first and

second gas outlets, the first gas passage being in fluid communication with the first inlet and first outlet, and the second gas passage being in fluid communication with the second inlet and second outlet, the first and second gas passages not being in fluid communication with each other. For a complete description of the apparatus see, for example, figs. 1 and 7, and their descriptions.

Chang does not expressly disclose that the plurality of gas outlets includes at least one on-axis outlet in the axial end surface and a plurality of spaced-apart off-axis outlets in the side surface. Murugesh et al. discloses an apparatus comprising a gas injector, the gas injector comprising a body including an axial end surface exposed within the processing chamber, a side surface extending axially from the axial end surface, and a plurality of gas outlets 85/247 including at least one on-axis outlet 85 in the axial end surface and a plurality of circumferentially spaced-apart off-axis outlets 247 in the side surface; a first gas line and a second gas line, the first gas line being in fluid communication with the on-axis outlet but not with the off-axis outlets and the second gas line being in fluid communication with the off-axis outlets but not with the on-axis outlet; wherein the outlets are disposed within the chamber and below the chamber ceiling (see, for example, figs. 2a, 2b and 3, and their description, and col. 2, lines 51-55). Therefore, in view of this disclosure, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Chang as to comprise the gas injector disclosed by Murugesh et al. in order to optimize the delivery of gas(es) into the chamber and in order to direct gas preferentially across a surface of the chamber.

Chang and Murugesh et al. do not expressly disclose a common gas supply including a single third gas line in fluid communication with the first gas line and the second gas line. Arami et al., Goodyear et al., and Ballance et al., disclose an apparatus comprising a gas injecting system in which a common gas supply 41,42,43/55,56 / 314 including a third gas line coming from the gas supplies is in fluid communication with a first gas line 38/ 21 /312 and a second gas line 39/ 22 / 310, the first gas line being in fluid communication with a first outlet and the second line being connected to second outlets, wherein the first line is in fluid communication with the first outlet but not with the second outlets and the second gas line being in fluid communication with the second outlets but not with the first outlet (see, for example, fig. 2 of Arami et al. and its description, fig. 1 of Goodyear et al. and its description, and fig. 8 of Ballance et al. and its description). Therefore, in view of these disclosures, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the gas supply system of the apparatus of Chang modified by Murugesh et al. so as to comprise a common gas supply including a single third gas line in fluid communication with the first gas line and the second gas line, in order to enable the injection of the same gas, to the processing chamber, through the on-axis outlet and the off-axis outlets. Furthermore, note that all the references disclose the use of flow controllers operable to supply the process gas from the common gas supply at flow rates that are independently varied toward the first line and the second line. Also, Arami et al. and Goodyear et al. disclose the use of a network of gas valves and throttling elements to independently vary the gas flow.

Additionally, note that the apparatus of Chang modified by Murugesh et al.:

a) comprises an RF energy source comprising an RF antenna 78, b) the gas injector injects the process gas toward a primary plasma generation zone in the chamber, c) the first gas line is in fluid communication with an axially extending central bore in the injector body, and the second gas line is in fluid communication with an annular gas passage surrounding the central bore, d) the injector body is cylindrical shaped and the off-axis outlets are circumferentially spaced apart, e) the gas injector can inject the process gas at subsonic, sonic or supersonic velocity, f) the on-axis outlet and the off-axis outlets are oriented at different angles relative to an exposed surface of the substrate, g) the plurality of gas outlets will be located/disposed within the processing chamber and below the interior surface of the dielectric member, and h) at least one of the on-axis and the off-axis outlets has a uniform diameter along the entire length thereof.

With respect to the off-axis gas outlets injecting process gas at an acute angle relative to the plane parallel to the exposed surface of the substrate, it should be noted that Murugesh et al. discloses that the gas injection angle from the off-axis gas outlets can be greater than or less than 90 degrees relative to the plane parallel to the exposed surface of the substrate, and that the gas injection angle is chosen depending on the pre-selected regions to which the gas is desired to be injected (see, for example, col. 6, lines 56-60). Therefore, it would have been an obvious choice of design to one having ordinary skill in the art at the time the invention was made to made the off-axis gas outlets so that they inject process gas at an acute angle relative to the plane parallel to

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the exposed surface of the substrate in order to inject gas into specific/desired chamber regions.

With respect to the system being a plasma etching system, it should be noted that such limitation is directed to a method limitation instead of apparatus limitation and since an apparatus is being claimed as the instant invention, the method teachings are not considered to be the matter at hand, since a variety of methods can be done with the apparatus. The method limitations are viewed as intended uses which do not further limit, and therefore do not patentably distinguish the claimed invention. The apparatus of Chang modified by Murugesh et al. is capable of performing an etching process if such method is desired to be performed in the apparatus.

With respect to claim 49, note that Murugesh et al. discloses the use of more than two circumferentially spaced apart off-axis outlets. Furthermore, a prima facie case of obviousness still exists because it would have been an obvious choice of design to one of ordinary skill in the art to optimize the total number of off-axis outlets during routine experimentation depending upon, for example, the desired locations to which the gas is desired to be injected, and would not lend patentability to the instant application absent the showing of unexpected results.

Claims 8, 10 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang, WO 99/57747 in view of Murugesh et al., U.S. Patent 6,450,117 and Arami et al., U.S. Patent 5,958,140, or Goodyear et al., U.S. Patent 5,532,190, or Ballance et

al., U.S. Patent 6,090,210, as applied to claims 1-7, 9, 11, 13-14, 39, 41-50, and 56-61 above, and further in view of Ni et al., WO 00/41212.

Chang, Murugesh et al., Arami et al., Goodyear et al. and Ballance et al. are applied as above but do not expressly disclose that the gas injector is removably mounted in the dielectric window. Ni et al. discloses an apparatus comprising a gas injector removably mounted to a dielectric window, the reference also discloses that the most preferred mounting arrangement for the gas injector is a removable mounting arrangement (see page 13-line 20 to page 14-line 2). Therefore, in view of this disclosure, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Chang modified by Murugesh et al. and Arami et al., Goodyear et al. or Ballance et al., as to removably mount the gas injector to the dielectric member because such mounting arrangement is suitable and preferred, and also, cleaning of the gas injector can be facilitated.

Claims 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chang, WO 99/57747 in view of Murugesh et al., U.S. Patent 6,450,117 and Arami et al., U.S. Patent 5,958,140, or Goodyear et al., U.S. Patent 5,532,190, or Ballance et al., U.S. Patent 6,090,210, as applied to claims 1-7, 9, 11, 13-14, 39, 41-50, and 56-61 above, and further in view of Powell et al., U.S. Patent 6,287,643.

Chang, Murugesh et al., Arami et al., Goodyear et al. and Ballance et al. are applied as above but do not expressly disclose that the gas injector is further provided with an electrically conducting shield. Powell et al. discloses an apparatus comprising a

gas injection tube 84 provided with an electrically conducting shield (see col. 9, lines 33-50) that minimizes plasma ignition until the gas reaches the main chamber (see Fig. 5 and col. 7-line 57 to col. 9-line 50). Therefore, in view of this disclosure, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Chang modified by Murugesh et al. and Arami et al., Goodyear et al. or Ballance et al., so as to further comprise an electrically conducting shield for the gas injector in order to minimize the plasma ignition within the injector because plasma ignition within the injector can result in detrimental effects such as damage to the injector as well as uniformity problems with processing within the chamber.

Claims 51-55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang, WO 99/57747 in view of Murugesh et al., U.S. Patent 6,450,117 and Arami et al., U.S. Patent 5,958,140, or Goodyear et al., U.S. Patent 5,532,190, or Ballance et al., U.S. Patent 6,090,210, as applied to claims 1-7, 9, 11, 13-14, 39, 41-50, and 56-61 above, and further in view of Hassan et al., U.S. Patent 4,270,999.

Chang, Murugesh et al., Arami et al., Goodyear et al. and Ballance et al. are applied as above but do not expressly disclose that the on-axis and the off-axis outlets includes an interior orifice contoured to provide sonic or supersonic flow therethrough. Hassan et al. discloses an apparatus comprising a gas outlet contoured to provide sonic velocity flow in order to achieve uniform flow distribution of the gas to be injected. In view of this disclosure, it would have been obvious to one having ordinary skill in the art

at the time the invention was made to modify the apparatus of Chang modified by Murugesh et al. and Arami et al., Goodyear et al. or Ballance et al., so as to contour the interior orifice of the on-axis and the off-axis outlets to provide sonic or supersonic flow therethrough, in order to achieve uniform flow distribution of the gas to be injected.

(10) Response to Argument

In response to appellant's arguments that the gas nozzle 96a of the Chang reference does not include a side surface extending axially from the axial end surface that includes even one off-axis outlet in such side surface, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). It should be noted that the Murugesh et al. reference, e.g. fig. 3, is used to show such limitation.

In response to applicant's argument that the Murugesh et al. apparatus operates differently than the Chang apparatus, and therefore, the combination is improper, the examiner respectfully wants to point out that the way an apparatus operates and/or is used has no relevancy as to whether the references can be combined under 35 USC 103. Furthermore, it should be noted that the apparatus of Chang and the apparatus of Murugesh et al. are capable of being operated/used similarly if desired. For instance, the apparatus of Chang can be used for a process such as the one disclosed by Murugesh et al., and the apparatus of Murugesh et al. can be used to perform a process such as the one performed by the Chang apparatus. Furthermore, note that the

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arguments are related to the intended uses of the apparatus of Chang or the intended uses of the apparatus of Murugesh et al., which are not particularly relevant to the claimed invention since the claimed invention is directed to an apparatus invention. Additionally, note that the references are not limited to the disclosed preferred embodiment(s) and/or use(s), therefore, other embodiments and/or uses not disclosed can be performed.

In response to appellant's arguments that the Chang reference does not disclose a common gas supply that supplies the same gas to both the outlet 96 and the outlet 98, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). It should be noted that the Arami et al., Goodyear et al. and/or Ballance et al. are used to show such limitation.

Applicant argues that the gas injector of the Chang apparatus and the gas injector of the Murugesh et al. apparatus requires more than one gas supply and more than one gas composition to be operable to achieve its intended purpose, and therefore, operates differently than the gas injector of the Arami et al., Goodyear et al. or Ballance et al. references, thereby making the combination of references improper. The examiner respectfully disagrees with such an argument and wants to point out that: a) the way an apparatus operates and/or is used has no relevancy as to whether the references can be combined under 35 USC 103, b) the arguments are related to the intended uses of the apparatuses of Chang and Murugesh et al., which are not

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particularly relevant to the claimed invention since the claimed invention is directed to an apparatus invention, and c) the references are not limited to the disclosed preferred embodiment(s) and/or use(s), therefore, other embodiments and/or uses not disclosed can be performed. Also, note that the Arami et al., Goodyear et al. and Ballance et al. references are used to show that a common gas source can be connected to more than one gas outlet. Furthermore, note that the Arami et al. reference disclose the use of three gas sources, all connected to the gas outlets of the apparatus by flow controllers, therefore, different permutations of gas introduction can be accomplished, e.g. one common gas can be supplied through all the gas outlets, or different gases can be supplied through the all or some of the gas outlets, depending on the process to be performed in the apparatus.

Appellant argues that the Murugesh et al. reference does not inject the gas from the outlets 85 and 247 downwardly toward the semiconductor substrate as in the Chang's structure. However, it should be noted that while in Chang the gas injected from outlet 96a is directed downwardly towards the substrate, the gas injected from outlets 98a is not injected downwardly toward the semiconductor substrate (as stated by appellant) rather the gas is injected towards the sides of the chamber. Additionally, note that a similar gas injector structure to the gas injector structure of Chang is disclosed in Murugesh et al. since the gas injected from outlet 85 is directed downwardly towards the substrate and the gas injected from outlets 247 is directed towards the sides of the chamber.

Appellant argues that the gas injector in Murugesh et al. does not have a cylindrical shaped body as claimed in claim 5. However, it should be noted that the primary reference already discloses such a feature and therefore, it is not necessary for the feature to be shown in the secondary reference of Murugesh et al.. Additionally, it should be noted that the configuration of the claimed gas injection body is a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed gas injector body is significant.

Appellant argues that Murugesh et al. gas outlets 85 and 247 are not oriented toward a surface, i.e. the same surface, much less toward an exposed surface of a substrate, as recited in claim 39. First, in response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., the gas outlets oriented toward a surface of the substrate, the gas outlets oriented toward the same surface of the substrate, or the gas outlets oriented toward an exposed surface of a substrate) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Secondly, it should be noted that the claim only requires that the outlets be oriented at different angles *relative* to an exposed surface of the substrate, therefore, as broadly claimed, any angle to which the outlets are directed will be relative to an exposed surface of the substrate and will read on the claim.

Appellant argues that the gas distributor in Murugesh et al. does not have a conical side surface as claimed in claim 7. However, it should be noted that the primary reference already shows such a feature and therefore, it is not necessary for the feature to be shown in the secondary reference of Murugesh et al.. Additionally, it should be noted that the configuration of the claimed gas distributor is a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed gas distributor is significant.

Appellant argues that the gas distributor of the Murugesh et al. reference does not include gas outlets which injects process gas at an acute angle relative to the plane parallel to the exposed surface of the substrate. However, as clearly stated in the rejection, Murugesh et al. discloses that the gas injection angle from the off-axis gas outlets can be greater than or less than 90 degrees relative to the plane parallel to the exposed surface of the substrate, and that the gas injection angle is chosen depending on the pre-selected regions to which the gas is desired to be injected (see, for example, col. 6, lines 56-60). Therefore, it would have been an obvious choice of design to one having ordinary skill in the art at the time the invention was made to made the off-axis gas outlets so that they inject process gas at an acute angle relative to the plane parallel to the exposed surface of the substrate in order to inject gas into specific/desired chamber regions.

In response to applicant's argument that the gas distributor in the Murugesh et al. reference cannot be removed, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary

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reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).


In response to applicant's arguments that the Powell et al. reference does not suggest a common gas supply, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). It should be noted that the Arami et al., Goodyear et al. and Ballance et al. references were previously relied upon to show such feature.

Regarding the comments with respect to the Hassan et al. reference, appellant has provided no reasoning as to why the rejection is improper and therefore the rejection is respectfully maintained. Note that a mere allegation that the reference fails to show the feature relied upon is insufficient to overcome a rejection.

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For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

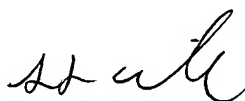


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